REMARKS/ARGUMENTS

Claims 6-9, and 13 are amended to correct the informalities identified by the Examiner. Claim 21 is newly added, which incorporates the limitations of originally filed claim 12 and claim 1. Claim 12 is accordingly cancelled, and claims 13, 15, and 17 are accordingly amended to change their dependencies from claim 12 to claim 21. Claim 5 is cancelled without prejudice. No new matter is added. Entry of the present Amendment is respectfully requested. Upon entry of the present Amendment, claims 1-4, 6-11, and 13-21 are pending. Reconsideration of the present application in view of the above Amendment and the following remarks is respectfully requested.

Claim Rejections under 35 U.S.C. § 112

Claims 6-9 and 13-16 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite, because the Examiner deems that there is insufficient basis for "the lower-voidage catalyst layers" in claims 6, 8, and 15 and "the high voidage catalyst layers" in claims 6, 7, and 9. In response, we have amended claims 6-9 and 13 and canceled claim 12. Hence, the rejections of claims 6-9 and 13-16 under 35 U.S.C. § 112 become moot in view of the present Amendment.

Claim Rejections under 35 U.S.C. § 102

Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by admitted prior art. According to the examiner, Applicants of the present application admit at page 4, lines 6-6 [sic, line 9] of the specification that the prior art teaches that it is conventional to operate a countercurrent operation with a catalyst bed voidage of greater than 0.95. The Examiner appears to misunderstand claim 1 of the present application.

Claim 1 is directed to a process for carrying out gas-liquid countercurrent processing comprising passing the liquid material and the gas reactant in countercurrent flow through the fixed bed of catalyst in a reactor. The fixed bed of catalyst includes two or more catalyst layers, with the difference of voidages between the adjacent catalyst layers being at least 0.05. Nowhere in the specification do Applicants admit that claim 1 is known in the prior art. To anticipate claim 1, the Examiner must identify each limitation of claim 1 in the prior art. For example, the Examiner does not identify where in the specification Applicants admit the limitations of "the fixed bed of catalyst includes two or more catalyst layers, with the difference of voidages between the adjacent catalyst layers being at least 0.05". Hence, we believe that claim 1 is not anticipated under 35 U.S.C. § 102(b).

Claim Rejections under 35 U.S.C. § 103

Claims 1-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gao et al. (U.S. Patent No. 6,117,812) in view of Imai et al. (U.S. Patent N0. 5,043,509).

Applicants respectfully disagree.

The present invention provides a process for carrying out gas-liquid countercurrent processing, comprising passing the liquid material and the gas reactant in countercurrent flow through the fixed bed of catalyst in a reactor, wherein the fixed bed of catalyst includes two or more catalyst layers, with the difference of voidages between the adjacent catalyst layers being at least 0.05 (see, e.g. 1). As explained in the specification in detail, in a gas-liquid countercurrent process, the gas and liquid phases undergo constant changes in volume and viscosity respectively, which have an important influence on the operating stability of the plant. An evenly distributed catalyst bed is used in the prior art, without considering the change of gas-liquid ratios at different sections of the reactors, and thus fails to improve the comprehensive operating flexibility and stability. One typical problem incurred from the use of evenly distributed catalyst in a gas-liquid countercurrent process is that flooding occurs at either upper section or lower section of the reactor, depending on the nature of the reaction. See paragraphs 0010 and 0020, etc. To prevent flooding in the fixed bed of the reactor, Applicants developed a process for carrying out gas-liquid countercurrent processing in a fixed bed of catalyst, which includes two or more catalyst layers, with the difference of voidages between the adjacent catalyst layers being at least 0.05 (see, e.g. 1). In addition, the present invention has other advantages, such as improvement of the product quality and catalyst life, etc. See, e.g., paragraphs 0020 and 0032-0046.

Gao, the primary reference relied upon by the Examiner discloses dual functional catalyst of packing type and the distillation equipment. At col. 6, lines 21-44, Gao discloses that in a catalytic distillation column, the upward flowing vapor stream and the downward flowing liquid stream passes countercurrently through the catalyst bed. However, as acknowledged by the Examiner, Gao fails to disclose at least two catalyst layers with different voidages, much less any specific voidage difference between two adjacent catalyst layers.

To remedy the deficiency of Gao, the Examiner cites to Imai. Imai discloses shaped catalyst particles utilizable for the conversion of organic compounds. The objective of Iman is to provide a catalyst particles which will provide a sufficient amount of voidage to enable any expansion of the catalyst particles without excessive loss of voidage and thereby allow a concurrent stability of pressure to be maintained (see, e.g., col. 1, line 65 to col. 2, line 7). As shown in Table 4 of cols. 11-12, the larger the voidage of catalyst bed layers is, the smaller the increase of the pressure drop of said catalyst bed layers as time goes by. Nowhere does Imai discuss gas-liquid countercurrent process in a fixed bed reactor. Nor does Imai teaches or suggests the use of at least two catalyst layers with different vodages in a fixed bed reactor, much less any specific difference of voidage between two adjacent catalyst layers. Neither does Imai discuss any problem associated with gas-liquid countercurrent process, such as flooding, and shortened catalyst life, due to the constant changes of the liquid and gas compositions, volume, and viscosity, etc., along the flow direction of the liquid or gas.

Applicants believe that claims 1-11 are not obvious over Gao in view of Imai under 35 U.S.C. § 103(a).

First, since concurrent process of Imai and gas-liquid countercurrent process of Gao are two different types of processes, a person of ordinary skill in the art would not have combined any teaching of Imai with Gao in arriving at the present invention. For example, one concern related to concurrent process is the pressure drop along the flow direction of the feedstock in the reactor; whereas the concerns related to countercurrent process is the constant change of gas-liquid ratios at different sections of the reactor and flooding.

Moreover, the prior art references, Gao and Imai, taken individually or together, do not teach or suggest using at least two catalyst layers with different voidages in a fixed bed reactor, much less the limitation recited in claim 1, "the difference of voidages between the adjacent catalyst layers being at least 0.05." See MPEP 2143 (The prior art reference (or references when combined) must teach or suggest all the claim limitations.) In other words, even if a person of ordinary skill in the art were to combine the teachings of Imai and Gao, as suggested by the Examiner, he or she would apply single evenly distributed catalyst layer with the voidage taught by Imai in Gao's process at most , since Imai does not teach or suggest the use of at two least two catalyst layers with different voidages or the necessity to adapt the process to the constant change of liquid/gas ratio in a gas-liquid countercurrent process or avoid the occurrence of flooding.

Therefore, based on at least the foregoing reasons, Applicants believe that claims 1-11 are not obvious over Gao in view of Imail under 35 U.S.C. § 103(a). Withdrawal of the rejections of claims 1-11 over Gao in view of Imail under 35 U.S.C. § 103(a) is respectfully requested.

The newly added claim 21 incorporates all the limitations of originally filed claims 1 and 12. Therefore, the reasons discussed above in connection with claim 1 are equally applicable to claim 21. Moreover, compared to claim 1, claim 21 further specifies that diesel oil distillate and hydrogen are processed in the countercurrent process. Neither Gao nor Imai discloses the processing of diesel oil distillate and hydrogen. This further supports that the newly added claim 21 is not obvious over Gao in view of Imai under 35 U.S.C. § 103(a).

Claims 1-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harrison et al. (U.S. Patent NO. 5,252,198) in view of the above-discussed Imai.

Harrison discloses a multi-step hydrodesulphurization process where the reaction is carried out in a column reactor having a plurality of reaction trays therein mounted one above another, the liquid sulfurcontaining hydrocarbon feedstock passes downward, and the hydrogen containing gas passes upward from tray to tray. However, as acknowledged by the Examiner, Harrison fails to disclose at least two catalyst layers with different voidages, much less any specific voidage differences of two adjacent catalyst layers. As noted above, nor can the secondary reference Imai remedy this deficiency.

For similar reasons discussed above in connection with claims 1-11, Applicants believe that claims 1-17 are not obvious over Harrison in view of Imai under 35 U.S.C. § 103(a).

First, since concurrent process of Imai and gas-liquid countercurrent process of Harrison are two different types of processes, a person of ordinary skill in the art would not have combined any teaching of Imai with Harrison in arriving at the present invention. For example, one concern related to concurrent process is the pressure drop along the flow direction of the feedstock in the reactor; whereas one concern related to countercurrent process is the constant change of gas-liquid ratios at different sections of the reactor.

Moreover, the prior art references, Harrison and Imai, taken individually or together, do not teach or suggest using at least two catalyst layers with different voidages in a fixed bed reactor, much less the limitation recited in claim 1, "the difference of voidages between the adjacent catalyst layers being at least 0.05." See MPEP 2143 (The prior art reference (or references when combined) must teach or suggest all the claim limitations.) In other words, even if a person of ordinary skill in the art were to combine the teachings of Imai and Harrison, as suggested by the Examiner, he or she would use single evenly distributed catalyst layer with the voidage taught by Imai in Harrison's process at most , since Imai does not teach or suggest the use of at two least two catalyst layers with different voidages or the necessity of adapt the process to the constant change of liquid/gas ratio in a gas-liquid countercurrent process or avoid the occurrence of flooding.

Therefore, based on at least the foregoing reasons, Applicants believe that claims 1-17 are not obvious over Harrison in view of Imail under 35 U.S.C. § 103(a). Withdrawal of the rejections of claims 1-17 over Gao in view of Imail under 35 U.S.C. § 103(a) is respectfully requested.

The newly added claim 21 incorporates all the limitations of claim 1 and claim 12. Therefore, for at least the same reasons discussed above in connection with claim 1, the newly claim 21 is not not obvious over Harrison in view of Imai under 35 U.S.C. § 103(a).

Based on the foregoing reasons, Applicants believe that the present application is in condition of allowance. Early and favorable consideration is respectfully requested.

It is believed that no fees or charges are required at this time in connection with the present application. However, if any fees or charges are required at this time, they may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,
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